

GLOBE Program™

Teacher's Guide



1997



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THE **GLOBE** PROGRAM™

744 Jackson Place, Washington, DC 20503 USA

Dear GLOBE Students:

You are about to begin an exciting adventure with students all over the world that will help all of us learn more about our planet! As participants in the *Global Learning and Observations to Benefit the Environment* (GLOBE) Program, you will collect environmental data in your school yard and neighborhood and you will share your findings with scientists and other GLOBE students.

Scientists have long been conducting research about the Earth's environment to understand how it forms a single, integrated system. However, scientists cannot take the Earth into a laboratory to study it. Instead, they must collect environmental data from all over the world continuously. Orbiting satellites collect much data about our planet, but people on the ground are needed to provide more detailed information. This is why you are an important member of the GLOBE Team.

As a GLOBE student scientist, you will assist scientists by taking careful measurements in the area around your school and reporting your data through the Internet. Your studies will include monitoring the air, water, soil, and vegetation. Each day you will be able to chart what is going on in the environment at your school, to compare your findings with data from thousands of other schools around the world and to have your data used to create pictures of the world environment based on GLOBE student data. You will be using your school computer to communicate with other GLOBE students involved in these same activities.

Scientists will be using your data to answer questions about our environment, and your data will continue to be useful ten, twenty, and even one hundred years from now! This is an historic opportunity for you to make a difference in your community and in our world. Scientists are anxiously awaiting your data...so let's get started!

Sincerely

Thomas N. Pyke, Jr.
Director

Visit the GLOBE Home Page at <http://www.globe.gov>
For information or assistance, call toll-free in the U.S. 1-800-858-9947 or e-mail info@globe.gov or help@globe.gov

Global Learning and Observations to Benefit the Environment
An International Environmental Education and Science Partnership



THE **GLOBE** PROGRAM™

744 Jackson Place, Washington, DC 20503 USA

Dear GLOBE Teacher:

Congratulations on joining a worldwide network of teachers, students, and scientists working together to learn more about our environment! Because of your leadership, your students have the opportunity to work with GLOBE scientists and other GLOBE students around the world in exciting and serious study that will generate new knowledge about our planet.

GLOBE is a bold adventure for teachers and students. GLOBE enables you to engage your class in a collaborative, inquiry-based learning experience. Your students will have opportunity to explore the corners of the world and the crevices of their own school yard. GLOBE will also enhance your efforts to integrate state-of-the-art technology into your everyday class activities.

This GLOBE Teacher's Guide provides important information from the GLOBE scientists and educators which outlines the student measurement procedures and data quality techniques. We need your help to ensure that students recognize the importance of their work to the science community and that they appreciate the need to follow the measurement procedures carefully.

We have also included a wide variety of Learning Activities that you may choose to integrate into your lesson plans. These activities build on the GLOBE measurement activities and help students understand the "why" and "how" of their work.

We look forward to working with you to keep GLOBE meaningful for both you and your students. If you have any questions or ideas, please contact the GLOBE Help Desk at 1-800-858-9947 or send email to: help@globe.gov.

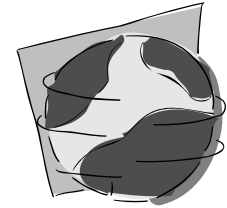
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The GLOBE Program Overview



Global Learning and Observations to Benefit the Environment (GLOBE) is a hands-on international environmental science and education program. GLOBE links students, teachers, and the scientific research community in an effort to learn more about our environment through student data collection and observation.

The goals of GLOBE are:

- to enhance the environmental awareness of individuals throughout the world;
- to contribute to scientific understanding of the Earth; and
- to help all students reach higher levels of achievement in science and mathematics.

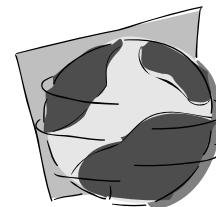
Students from the ages of approximately five through eighteen years in schools throughout the world conduct a continuing program of scientifically meaningful environmental measurements. GLOBE students transmit their data to a central data processing facility via the Internet, receive vivid images composed of their data and data from other GLOBE schools around the world, acquire information from a variety of sources, and collaborate with scientists and other GLOBE students and communities worldwide in using these data for education and research.

The measurements taken by the GLOBE students serve two important purposes. First, participating scientists use these data in their research programs to improve our understanding of the global environment. Second, students not only learn how to carry out a scientifically rigorous program of Earth observations, but also learn to use their own measurements, together with data from other GLOBE schools, as a key part of their study of environmental science. Through contact with and mentoring by scientists, the students receive feedback about the value of their data sets in world class scientific research.

GLOBE provides extensive educational materials to enrich the learning experience of participating students. These materials include a wide variety of classroom and field activities to help students place their measurements in a broader context and relate their own local observations to global environmental issues.

Using state-of-the-art technology, GLOBE creates a forum for students to communicate with their peers around the world, thus fostering alliances among students and increasing not only their environmental understanding but also their understanding of other cultures and their sense of global community.

GLOBE Science and Education



The GLOBE Program is both an international environmental science research program and an environmental science education program which, by design, includes a tight coupling between the two. This design was a result of a series of workshops that brought together international representatives of the science and education communities. There was agreement from both groups that science and education in the GLOBE Program should be mutually reinforcing.

The balance between science and education is reflected in the Teacher's Guide. The GLOBE science and education processes are represented in the scientific protocols and the educational learning activities. The implementation of this perspective has required involvement of both scientists and educators. Thus, peer-reviewed competitions are conducted to select Scientist Principal Investigator and Educator Co-Principal Investigator teams to develop GLOBE scientific and supporting educational materials and to select Educator Principal Investigators and Scientist Co-Principal Investigator teams to develop educational materials and provide evaluations and assessment tools.

These teams have designed measurement protocols that are appropriate for primary and secondary school students and that ensure accurate and reliable measurements for use by the international environmental science community. The GLOBE scientists will employ the GLOBE student measurement data in peer-reviewed publications and promote the use of these data to their colleagues. GLOBE is a hands-on, minds-on effort in which students will become the environmental experts for their study sites. GLOBE students do not just learn about science, they do science.

The GLOBE Program fosters the creation of a worldwide research team, comprised of students and teachers in collaboration with environmental scientists for the purpose of generating knowledge about the Earth as an interconnected system. In a

similar manner, this team collaborates in facilitating the learning of science by students worldwide.

GLOBE learning activities are designed to promote the understanding of science through the use of tools such as visualizations and satellite images. Most GLOBE schools are able to communicate with one another through GLOBEMail, and some have used this capability to establish multi-country teams to initiate environmental science research projects. The activities of the teachers and students are strengthened by interaction with members of the science community.

Evolution of the GLOBE Program

As the GLOBE Program has evolved, it has been refined to keep all of the measurements and equipment as straightforward as possible and provide scientific methodologies suitable to the skill levels of the students. Therefore, in the current Teacher's Guide, while some of the protocols initiated in previous versions of the Teacher's Guide remain unchanged, some have been improved, and some new protocols have been added to the GLOBE science program. This evolution is an outgrowth of the desire of GLOBE Program management, scientists, and educators to be responsive to the needs of the primary and secondary education community as well as to provide for the best environmental science.

All of the GLOBE schools are strongly encouraged to participate in the full range of GLOBE science measurements. Additionally, schools are strongly encouraged to take advantage of the learning activities which are designed to promote the learning of science in conjunction with the protocols.

GLOBE Science and Inquiry Processes

The Teacher's Guide facilitates the learning of science by use of the inquiry process. The inquiry process used by the GLOBE Program is an approach to learning which parallels the scientific method used by scientists. This process is represented in the combined package of the protocols and learning activities. The protocols focus on data collection and data reporting. The activities broaden from the data collection and data reporting to include other parts of the inquiry process such as formulation of hypotheses, analysis of data, and drawing of conclusions.

The science process used by researchers parallels the inquiry process used at the K-12 level. The primary difference is the outcome for each group. In schools, the primary outcome is learning science. At the research level, the outcome is generation of knowledge. The data collection and data reporting done by the students provide data to the research community and these data are used in the generation of new knowledge. The scientific research community analyzes the data, draws conclusions and reports results which are communicated back to the teachers and students.

In GLOBE, the science and inquiry processes are linked via communication between the GLOBE students and scientists. This communication occurs when the students' data are reported for use in the generation of knowledge by the science community and by the transmission of visualizations and results of research by the science community to the schools. GLOBE scientists answering the questions of teachers and students in person, through correspondence, and over the World Wide Web in real time are included in this communication.

Science Concepts and Skills as Key Elements of the GLOBE Teacher's Guide

To improve students' understanding of science, the scientist/educator teams have developed learning activities to help students learn and apply science content and thinking skills. The scientists defined the key science concepts in simple terms. GLOBE scientists and educators then designed educational activities to help students learn the key science concepts along with the science protocols. Students and teachers use the learning activities to strengthen their understanding, explore local and global data, experience the scientific method, and design and implement their own investigations. In the process, students also focus on issues of data quality. Since quality science is dependent on quality data, calibration and quality control procedures are specified in the protocols and are critical to the success of GLOBE. Specific learning activities reinforce the importance of data quality.

A major challenge in preparing the Teacher's Guide was making it appropriate for a broad spectrum of grade levels. Key science concepts and skills are represented in each protocol and learning activity. The concepts and skills are used in two ways. First, the concepts and skills guide the development process. Second, the concepts and skills help the teachers integrate the learning activities into their local curriculum.

The GLOBE Program is always evolving and will continue to provide science and learning activities that take advantage of the increased experience and enhanced skills that students have acquired to introduce more complex science concepts, more sophisticated insights into environmental research, and improved science achievement. As students achieve higher levels of scientific understanding, they will be challenged to move from a specific discipline to a multi-disciplinary perspective and from a local to a global perspective.